FOREST RESEARCH NOTES

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RECENT TRIALS WITH 2,4-D AND 2,4,5-T TO KILL BRUSH IN THE SIERRA NEVADA IN CALIFORNIA

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Brush competition is one of the more serious obstacles to survival of both planted and naturally established trees in California. Brush has taken over many cutover and burned areas. In the western Sierra Nevada alone, 1.7 million acres of commercial forest land are classified as poorly stocked or non-stocked. 1/ All of this area is capable of producing forest trees, but brush dominates most of the ground and greatly hinders efforts by man and nature to reestablish conifers in adequate numbers. If these acres are to produce timber within a reasonable period, the brush must be either eradicated or killed in place. Chemical sprays offer one possibility for killing brush. This report describes the results of several experiments with two selective herbicides tested against five different brush species on the Stanislaus Experimental Forest.

Experimental Trials

Five experiments were designed to determine the effect of herbicides applied as foliage sprays at different times during the summer and fall on brush sprouts and old plants. The species studied were: Mountain whitethorn (Ceanothus cordulatus Kell.), Sierra evergreen-chinkapin (Castanopsis sempervirens Dudl.), bearmat (Chamaebatia foliolosa Benth.), littleleaf ceanothus (Ceanothus parvifolius Trel.), and greenleaf manzanita (Arctostaphylos patula Greene). The herbicides used were low volatile esters of 2,4-D (2-4-Dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid). Also tested were two substances, Tween 20 (polyoxyethylene sorbitan monolaurate) and Carbowax 1500 (an emulsified wax), as possible adjuvants to increase the

1/ Forest Survey Staff. Forest Statistics for California. Calif. Forest and Range Expt. Sta. Forest Survey Release 25. 66 pp. illus. 1954.

Table 1.--Percent foliage kill, crown reduction, and total kill by 2,4-D and 2,4,5-T sprayed on several brush species at [illegible] dates in 1950

Species and age of plants	Date sprayed	Maximum foliage killed		Crown area reduction, 1955		Entire plant killed, 1955	
		2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T
		Percent					
Mountain whitethorn:							
Young sprouts	6-30	100	92	100	80	100	80
	7-27	96	98	40	60	40	60
	8-23	96	96	50	80	40	80
	9-27	90	100	20	60	20	60
	11-10	84	100	0	80	0	80
Old plants	6-30	94	98	20	30	20	0
	7-27	82	100	20	36	0	20
	8-23	100	100	40	54	0	20
	9-27	90	100	16	18	0	0
	11-10	44	100	20	58	0	20
Sierra evergreen-chinkapin:							
Young sprouts	6-30	100	100	0	0	0	0
	7-26	56	90	8	42	0	20
	8-23	60	98	32	64	20	60
	9-27	28	100	0	90	0	60
	11-10	56	100	2	90	0	0
Old plants	6-30	46	98	10	38	0	0
	7-26	96	100	18	48	0	0
	8-23	56	100	16	68	0	0
	9-27	58	100	18	90	0	20
	11-10	20	94	0	22	0	0
Greenleaf manzanita:							
Old plants	7-3	90	100	76	95	60	90
	8-7	85	97	71	87	50	50
	8-24	95	96	94	90	70	50
	9-28	100	100	100	85	100	40
	11-10	97	100	95	91	90	60
Whiteleaf ceanothus:							
Old plants	7-3	84	100	84	100	60	100
	8-7	100	100	100	100	100	100
	8-24	100	100	100	100	100	100
	9-28	43	100	43	100	30	100
	11-10	48	100	48	100	30	100

Table 2.--Maximum foliage kill, crown reduction, and total kill of Sierra evergreen-chinkapin sprayed in 1950 with 2,4-D and 2,4,5-T at 5 different times during the day

Time sprayed	Maximum foliage killed		Crown area reduction, 1955		Entire plant killed, 1955	
	2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T
	Percent					
7:00 to 8:30 a.m.	97	99	40	76	20	30
9:30 to 11:00 a.m.	88	99	31	64	10	40
12:00 to 1:30 p.m.	58	98	19	38	10	10
2:30 to 4:00 p.m.	58	94	5	41	0	0
5:00 to 6:30 p.m.	92	99	41	51	10	20

Table 3.--Maximum foliage kill, crown reduction, and total kill of mountain whitethorn sprouts sprayed with two adjuvants and herbicides in 1950

Treatment	Maximum foliage killed	Crown area reduction, 1955	Entire plant killed, 1955
	Percent		
Control:			
2,4-D	99	25	20
2,4,5-T	100	80	80
Tween 20:			
2,4-D	98	28	20
2,4,5-T	100	74	68
Carbowax 1500:			
2,4-D	91	28	24
2,4,5-T	100	79	76

Discussion

The effect of hormone sprays, 2,4-D and 2,4,5-T, was found to vary with species, age of plant, and time of application. Complete kill was hard to achieve, but the total crown area of most species studied was reduced sufficiently to permit trees to compete favorably with the brush that survived spraying.

Littleleaf ceanothus was the least difficult to kill. All clumps of this species sprayed with 2,4,5-T were dead within a year after treatment. The same results were obtained with 2,4-D when sprayed in August but when sprayed earlier or later in the year 2,4-D killed only 50 to 60 percent of the plants. Since 2,4-D is cheaper than 2,4,5-T, it would be advisable to spray littleleaf ceanothus with 2,4-D in August. If treatment in August is impossible, 2,4,5-T should be used.

Bearmat was found to be most susceptible to 2,4-D after August. 2,4,5-T was not tested on bearmat. Concentrations of 2,000 to 4,000 p.p.m. of 2,4-D acid in water produced the best results.

Greenleaf manzanita was killed by both herbicides. All plants sprayed with 2,4-D at 3,000 p.p.m. on September 28 were killed. Of those sprayed in November, 90 percent were killed. If spraying is earlier in the year, 2,4,5-T should be used. A kill of 90 percent was recorded with 2,4,5-T when sprayed the first of July, but after that date 2,4-D was superior to 2,4,5-T.

Sprouts of mountain whitethorn were easier to kill than older plants. The best control was achieved by June 30 application of 2,4-D. After that date 2,4,5-T was more effective and therefore should be used for later spraying. It is possible that mountain whitethorn sprouts could be effectively sprayed with 2,4-D during the end of May and June. Very few of the old plants were killed by either herbicide. The best reduction of crown area was obtained with 2,4,5-T sprayed in November, therefore, it is recommended that old mountain whitethorn be treated with 2,4,5-T during late fall. Further tests would be desirable to determine a more effective control of mature mountain whitethorn.

Sierra evergreen-chinkapin was the most difficult species to kill, although young sprouts were less resistent than old plants. Very few of the young sprouts and none of the older plants treated with 2,4-D were killed. Young sprouts should be treated with 2,4,5-T during September to November. Although some of the sprouts that were sprayed with 2,4,5-T on November 10 were killed, 50 percent of the crown area was eliminated. Best results with older plants were obtained with 2,4,5-T on September 27, therefore it would be advisable to spray them with 2,4,5-T during September and possibly the early part of October.

The results of the time of day test on Sierra evergreen-chinkapin indicated that the plants should be treated during the early morning and late afternoon. The same finding may apply to the other four species, but it was not tested.

Neither of the adjuvants increased the killing power of marbles at the concentration tested. Further tests should be conducted with wetting agents and chemicals that increase the absorption of lethal sprays by the plants. These substances should be tested on the more resistant species--especially old plants of mountain whitethorn and Sierra evergreen-chinkapin.